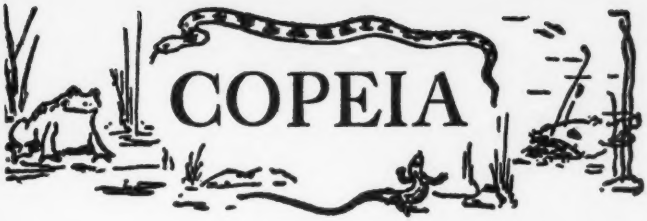


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## NOTE ON THE ROOSTERFISH

Recently (December, 1927 and January, 1928), Joseph R. Slevin and Frank Tose, of the staff of the Museum of the California Academy of Sciences, made a trip to the Galapagos Islands as guests of Captain G. Allan Hancock on his vessel the S.S. Oaxaca. On the way down and back Captain Hancock and those of his guests who are enthusiastic anglers, availed themselves of the opportunity to do some ocean fishing. One of the localities that they tried out was the waters about the Tres Mariettas, a group of small islands off Banderas Bay, Jalisco, Mexico. Among other fishes caught in those waters by Captain Hancock on December 30, was an unusually large example of the Roosterfish or Papagallo, *Nematisstius pectoralis*.

The fish was 4 ft. 9 in. long from tip of nose to tips of caudal fin, or 4 ft. to base of caudal lobes. The eight when caught was 65 pounds.

The following notes were taken after the fish had been in cold storage 24 days.

Weight 50.5 pounds. Head in length, 4; depth 4; eye in head, 8; snout 3; maxillary 2.2, rather broad, rounded, with a well-developed supplementary bone slipping under edge of preorbital, fitting into a shallow depression, and extending to anterior edge of pupil; mandible 2; a deep notch under preopercle; mouth oblique, the cleft not continued under eyes. A high, thin ridge resembling an accessory scale just above ventrals and adnate to body; pectoral base a deep pit in which the fin freely revolves; ventral peculiar in having a ventral membranous wing or extension which is narrowly separated from the extension on the opposite side, the two with their base in a scaly sheath. Dorsal fin VIII–I, 17; scales 15—ca. 160—42.

First dorsal spine very short, the others greatly prolonged in long filaments gently curving backward

like the feathers in a rooster's tail, each 12 to 16 inches in length; rays of dorsal, except the last, of only moderate length, the last elongate; base of dorsal almost as long as the back, extending from near the nape to a distance about 2.6 times the length of the head; the scaly sheath has a tendency to run up some distance on the last elongate broad ray; pectoral long, acute, slightly falcate, of 14 rays, the rays much branched, the third and fourth longest, their length being somewhat greater than that of the head; ventrals subacute, somewhat falcate, the first ray the longest, its length about half that of the pectoral fin; anal with its first and last rays longest, the last ray resembling the elongate last ray of the dorsal; outline of its membrane slightly concave, the margin somewhat feathery from the projections of the much branched rays, the first and last rays about equal to length of snout; anal base comparatively short, its length equal to distance from tip of snouth to edge of preopercle or about 1.4 in head; lobes of caudal widely diverging, acute, equal, their length a little greater than that of head, the first few rays strong, bony and apparently ankylosed; membrane of caudal covered with minute scales; a peculiar furrow like a cut, at the base of each caudal lobe.

The description and plate in Jordan and Evermann's "Fishes of North and Middle America", (p. 895, pl. 138, fig. 377), were based on a specimen only nine inches long, and do not apply very well to the adult. In our specimen the anterior profile is not strongly decurved from the dorsal fin to the eyes and the depth is relatively less.

The statement on page 895 that there are eight very long filamentous dorsal spines is evidently a misprint, as is also that there are only 119 scales in the lateral line. Only 7 dorsal spines are long and

filamentous, and there are many more scales in the lateral line; we count about 160.

At the time the fish was taken the captain was trolling from his motor boat making about three knots, using a light rod and No. 24 line with a wooden spinner as lure. The fish came at the lure in a great rush from some distance and could be plainly seen. It acted somewhat like a tarpon when hooked, but did not jump or sound. Although it put up a magnificent and vicious fight, the captain brought it to gaff in about fifteen minutes.

Other, but smaller, specimens were taken about the Tres Mariettas also off Cabo San Lucas, and Captain Hancock regards this species as one of the really great game fishes of Pacific coast of Mexico.

According to Captain Hancock and to Mr. Tose, who was present at the capture of the fish, it has excellent game qualities, putting up a vigorous and continued fight, not leaving the water however, as does the tarpon and tuna but coming near enough to allow the brilliantly colored dorsal spines and rays to project above the water. When first taken out of the water, it was a brilliant object, the ground-color being of pearly translucency, with four or five iridescent bands, varying from purplish to deep green, forming zebra-like markings, these colors fading immediately after death. These colors are given in detail and with fair accuracy in the description in Jordan and Evermann, but they are unknown to the curator or laboratory ichthyologist, being reserved for the reward of those who go a-fishing, and lend additional zest to the capture of the fish.

As a food-fish the Roosterfish is of excellent quality; the flesh is very dark, resembling in appearance that of lean beef and in flavor that of the sturgeon.

Captain Hancock has kindly presented this fine

specimen to the Museum of the California Academy of Sciences. It has been mounted by Mr. Frank Tose, Chief of Exhibits, and is now on display in the Steinhart Aquarium of the Academy.

BARTON WARREN EVERMANN
H. WALTON CLARK

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## STRANGE PHENOMENON IN FISH MIGRATION NEAR FAR-EASTERN COASTS OF THE PACIFIC OCEAN

In 1922 in the Possiet Bay, south of Vladivostok, appeared, at the first time in commercial quantity, a southern species of *Clupeidae* family known under the Japanese name "iwashi"—*Extrumeus micropus* (Temminck and Schlegel). Single specimens of this fish, together with another southern fish *Konosirus punctatus* (Temminck and Schlegel), were caught occasionally on the Russian coasts near Vladivostok, but they never appeared in abundance. Beginning from 1922, "iwashi" became there a commercial fish and, what is more surprising, every year it moved farther and farther to the north along the coasts. In 1924 it reached Amur river Bay* and in 1925 it appeared at the same time near all coasts beginning from the Ussuri river Bay up to Samarga and Datt and its shoals were so enormous that the water seemed "boiling" from the masses of this small fish. Local people caught it easily by baskets, buckets, etc. On one stormy day many shoals of this fish were thrown out on the shore where it formed large heaps and putrified.

The run took place during the months of September, October and November. This was not its spawning time. The fishermen noticed that in some places dead

*This fish reported from Nagasaki (not farther to the north). From this point to the Amur River Bay more than 1500 miles.

fish covered also the bottom in thick layers, forming a kind of "fish burial".

Together with this fish came another southern animal—deep sea cuttle fish (*calmar*, *Sepia*). The local fishermen have never seen it before and did not know what to do about it.

The fact of appearing of southern fishes and mollusks, in great number, in a northern region is probably connected with a sharp change of the water temperature and of the content of the planctonic organisms. Unfortunately no investigation was made at the time mentioned above in the said places. The author has also no reference about any later observations, probably made by the "Pacific Station for the Scientific Investigations of Fisheries", recently opened at Vladivostok.

Another question, more complicated, what was the cause of the supposed change in the marine regime of this region,—cannot be answered because of lack of the oceanographic observations made regularly, as it is accomplished in some parts of the Atlantic ocean. Quite possible that these sudden changes are caused by changes of the relief of the ocean bottom, due to the volcanic activities in the region of the Japanese islands. The phenomenon might have some connection with the disastrous eruption of the volcano near Tokio. Of course this is only a supposition.

N. Borodin

## THE LIFE-HISTORY OF *TRITURUS VIRIDESCENS*—SOME FURTHER NOTES

In a recent paper (Noble, 1926) on the Long Island newt, Noble has attempted to show that, like the man who was knocked down after declaring that he could lick anybody in the United States, I took in too much territory in some of my statements about the life-history of *Triturus*. With one exception (the

texture of the skin) all of his criticisms are based upon local conditions on Long Island and do not apply to the greater part of the animals' range, therefore they do not affect my conclusions directly. The purpose of this article is to answer these criticisms, consequently the outline will follow that of Noble's paper.

Noble assumes that the absence of newts from coastal plain ponds on Long Island is due to the acidity of the water but he offers no direct proof. Some of the most typical habitats of the newt in central Maine are small, swampy "muck holes" many of them partly chocked up with cat tails, peat moss and other decaying vegetation. The same is true of Denny's Pond near Pittsburgh where I found the animal very abundant. This condition would tend to make the water acid and to throw doubt on Noble's conclusion. In central Maine moreover, granite and gneiss are the prevailing rocks, which would tend to make the waters acid. A series of chemical analyses of the water from various habitats would be the only way to decide this question.

In a letter of recent date Mrs. H. H. Wilder has called my attention to another significant fact:

"Neither, in my opinion, does the fact of the absence of the species from ponds in the coastal plain [mean anything] unless he is sure that *ducks*, which are very extensively raised on Long Island South Shore region, do not have access to these ponds. One summer at Cold Spring Harbor we found a great abundance of newts (adults) in Mrs. Davenport's pond up by her farm house on the hill. The next summer we searched the pond repeatedly without finding a single specimen! Meanwhile her tenants at the farm had introduced ducks!"

## Life Cycle

In two collectings Noble has found 12 immature specimens in the water. The seven taken May 30,

1925 averaged 53.4 mm. total length and the five taken July 9 of the following year* averaged 74.5 mm. He concludes:

"From these data it is clear that some Long Island newts pass the early part of their life as metamorphosed individuals (red eft stage) in the same ponds as the adults. Further, the immature metamorphosed newts undergo a rapid development in the water. It is therefore highly probable that they do not require more than one season as a metamorphosed individual to reach sexual maturity. This conclusion is based upon only twelve individuals and should be supplemented by other evidence. The present evidence, although brief, demonstrates fully, and for the first time, that some newts undergo the early part of their postmetamorphic life in the water. The inference is that all newts on Long Island similarly skip over the terrestrial stage in their life cycle."

In another paragraph he attacks my conclusions:

"The statistical evidence given by Pope is based upon comparatively few individuals (105 in one case, 284 in another). Further, there are only two lots of 50 and 55 individuals, respectively in this series which afford valuable data in such a study as he made, for urodeles metamorphose at greatly different sizes according to the temperature of the habitat. Graphs to be convincing, would have to be based on animals collected in a single locality."

It is hard to see how a scientist could write these two paragraphs in the same paper. In the one he draws sweeping conclusions from 12 animals and in the other he attacks mine based on 105 as supported by insufficient data. It is true that he apologizes for the small numbers used, but so did I for my 105.

A review of the data from which my graphs were

*On page 4 the date of the second collecting is given as July 9, 1926, while on page 10 it appears as July 9, 1925. If the first date is correct it weakens Noble's conclusion badly, for conditions of food, temperature, etc., may vary considerably from year to year in the same pond.

made shows that out of 72 aquatic newts taken at Williams Pond, Sunderland, Mass. on March 27, 1921, eight were between the lengths of 71 and 79 mm. and of 95 taken at the same place on June 15 of that year 14 fall into this group. (See fig. 1.) The average of these 22 animals is 75.5 mm., within one millimeter of that of Noble's second group, so that except for the fact that these five newts were immature (and some of mine may have been) the finding of aquatic newts of this size is nothing new.

The range in size among Noble's seven newts taken May 30 is quite large, 42.5 to 66.5 mm., a range which corresponds to the entire second and third groups in my graph (Pope 1924, fig. 19). If we take the average, 53.4, and assume in the absence of data that Long Island newts metamorphose at the same size as those on the mainland (about 31 mm.), it then appears that these animals must have made a growth of at least 22 mm. from late July or August until the following May. As this period includes winter and food is very scarce for nearly half of this time such an enormous growth seems very improbable. At best Noble has left a wide gap in his chain of evidence. Apparantly he has not studied the larva at all nor found any recently metamorphosed animals and we can hardly consider 53 mm. newts to be in "the early part of their postmetamorphic life." Apparently none of these small newts retained gill stubs and it may well be that they had returned to the water that spring or the previous fall after spending a year on land.

The "rapid development in the water" which Noble postulates cannot be proved by 12 animals taken in two collectings. If he had followed up his first collecting by several more the same year and filled in the gap between larva and late postmetamorphic life he might have a conclusive piece of evidence. It is true that "...urodeles metamorphose at greatly different sizes according to the temperature of the habitat."

This applies to such forms as *Eurycea* but not to *Triturus viridescens* as far as I have been able to learn. In my earlier paper (Pope, 1924, p. 316), I described a cold, spring fed pond in Manchester, Maine, where metamorphosis was delayed for as much as two or three weeks, yet none of the larvae grew any larger before metamorphosis than those in warm, shallow pools either in Maine or Pennsylvania. Laboratory conditions do not seem to influence size either, for the larvae raised from the egg metamorphosed at about the same size; from 28 to 34 mm.

Various observers, from Monks (1880) down, have agreed that the larva becomes terrestrial upon metamorphosis. After a certain stage the metamorphic newt becomes helpless in the water and sometimes drowns unless given a chance to crawl out on land. Some larvae collected on Long Island and allowed to change in the laboratory might furnish more conclusive evidence about the early postmetamorphic life of the Long Island newt than Noble's dozen specimens.

I can hardly agree with him that "It is possible that the red land stage is omitted from the life cycle of other lowland newts, for, as Pope (1924) has pointed out, red efts are very rare in some regions." I have found metamorphic or recently changed newts frequently in Manchester, Maine, which is one of the places where the land form is so rare. These newts were always either terrestrial or becoming so; further, there is much negative evidence from Gage (1891) down to show that intermediate sizes are not to be found in the water. In Maine small aquatic newts are even scarcer than their red brothers on land. I can recall seeing only two or three in my life and doubt if those measured less than 70 mm. One of these was a sexually mature male. Negative evidence is, of course, unsatisfactory but much less so with aquatic than terrestrial newts. If there were early

postmetamorphic newts in the ponds with the adults it is hard to see how they could escape capture when the net brings in both adults and larvae. On the other hand the red eft has all out of doors to hide in and often does so very successfully, even in regions where it is common. Let me quote Mrs. Wilder again:

"...At times we have found them by the fifties along the road at camp (Mt. Toby, Sunderland, Mass.), and at other times (at the same time of year), we have searched everywhere through the same region without finding one. I think it takes a certain combination of conditions of moisture, temperature and other things to bring them out. Perhaps they make extensive migrations at times and we happen to meet them on the way."

Mount Toby is the favorite collecting ground of the Smith College Zoology Department and the Wilders tell me that since 1921 red land newts have not been reported from there in any numbers. In view of this extreme variability it is not at all impossible that red efts may occur on Long Island without Noble's knowledge.

The following from Noble's paper shows that the question of the duration of the terrestrial stage is still a controversial one:

"Pope (1924, p. 329) concludes that it (the terrestrial stage) lasts three years, for the newts enter the water 'when they are three and a half years old and have reached the length of about 80 mm.' I have collected aquatic newts in New Jersey measuring from 63.5 to 104 mm. in total length (32.5 to 49 mm. head and body). As the extremes were sexually mature female newts, it is natural to assume that the mainland newts vary enormously in size at the time they reach sexual maturity and return to the water. Further, the evidence given above would show that the red aquatic newts on Long Island remained only a single season in the water before reaching sexual maturity.

In view of such direct evidence that newts return to the water at different sizes, Pope's statistics based largely on individuals without definite habitat notes cannot be accepted. There is in short no definite proof that newts remain more than one year as metamorphosed individuals without reaching sexual maturity."

This paragraph proves very little. Were these New Jersey newts taken in one or several localities? Was the 63.5 mm. sexually mature female one of many small ones or a single aberrant individual? The finding of one small animal does not show that newts "vary enormously in size" at the time of their return to the water. What was the average length of the entire group? Until these questions are answered we can attach very little importance to a statement of this kind. Noble would have done well to continue the above quotation from my paper (Pope, 1924, p. 329) by two more sentences: "Probably some remain on land until the next spring, as Miss Smith (Mrs. Pope) has suggested, and possibly a few of them even longer. Figs. 16, 17 and 18 (cf. Pls. XLVII and XLVIII) show so much overlapping (in total lengths of land and water forms) that it does not seem likely that the return to water always occurs at the same age or at the same time of year."

Figure 2 shows total lengths of 164 newts taken in seven collectings at Denny's Pond, Harmar, Pa. Comparing this with the graph of all water forms measured (Figs. 17 and 18, Pope, 1924), shows the same features; a few individuals just over 70 mm., a larger group at about 80, a rapid rise in numbers to the mode just above 90 and a slower decline beyond the mode. The average total length of these newts was 94.34 mm., quite close to the mode. It will be seen that to say, as Noble did, that the lot ranged between the extremes in length would give the impression that the average was only 88 mm. The

collectings were made during the months of November, 1920, and March, April and May, 1921.

When the figures for the 315 aquatic newts from the Pittsburgh region in the Carnegie Museum are added to this graph (which lack of space forbids printing) the contour is not greatly changed. Three more are added to the short end of the 80 mm. group though none of these is below 77, the gap between this and the main group is closed, the total average rises to 95.71 and the maximum to 119 mm. but the mode, the general contour of the curve and the isolation of the one 72 mm. specimen remain the same.

Comparing with these graphs one of the 167 aquatic newts taken at Williams Pond, Sunderland, Mass. on March 27 and June 15, 1921 (Fig. 1) the same features are shown with modifications. The average total length is smaller, 86.69 mm., than in those from Pennsylvania. This brings the mode down to the 80-85 mm. group instead of the 90-95 and the curve is flatter with a rather more gradual drop to the maximum length at 106 mm. Half a dozen individuals fall into a group just over 70 mm. and the sharp rises at 75 and 80 seem to correspond to those at 80 and 90 mm. in the other graph. It seems probable that the newts in this locality enter the water at rather a smaller size than those in the Pittsburgh region, corresponding to their smaller average size, yet Fig. 19 (Pope, 1924) shows that the 50 animals caught in the act of entering the water averaged 79.70 mm., the most direct evidence that has yet been produced about the length of the newts at the time they enter the water.*

In view of the fact that detailed study of the statistics on which my conclusions were based only strengthened them and that Noble has no new evidence except

*The Williams Pond habitat has been sufficiently described in my former paper, Pope, 1924, p. 332.

two 63 mm. animals I see no reason to change my statement about the size or age at which newts on the mainland generally enter the water.

The first part of Fig. 19 (Pope, 1924) shows in addition to the measurements of 55 red efts taken at Branchville, N. J. (Culver's Lake), those of 5 specimens from Amherst, Mass. Two of these last fall into the third mode and one into the second while the remaining two help fill in the gap, between these modes. It will thus be seen that these five animals could be eliminated without making the modes less distinct.

The 55 terrestrial newts charted were collected in June, 1920, and mailed to me. I received them in Manchester, Maine on the 17th and 21st of that month so that they may fairly be grouped together. The Culver's Lake region where they were taken is typical hilly country of northern New Jersey, very rocky and fairly well wooded with hardwood growth. The pond itself is perhaps two miles long apparently fairly deep and with clean shores except for some marshy coves. I was unable to get a series of newts from the water.

Returning to the graph, I see no reason to change my statement that the three distinct groups probably represent animals one, two and three years old. The great variation in size of these animals, taken at the same place and the same time of year, makes it impossible to believe that all were hatched the same year or that all would have become sexually mature and returned to the water the same year. Noble has found two aquatic specimens in New Jersey as much as 8 mm. shorter than any of mine but that and the very indirect, not to say brief, evidence from Long Island hardly refutes my conclusions. He has made no study of the red eft himself, he has no theory to account otherwise for the three groups into which my Branchville newts fall and until he does so account for

them or produces some evidence as direct as the above, which he has not done yet, he is hardly in a position to reject my conclusions.

The fact that his newts from Newfoundland, N. J. averaged only 84.75 mm. as against 86.69 from Sunderland, Mass. and 95.71 from the Pittsburgh region may partly account for the small minimum size. With a variety of country from salt marsh to mountains in New Jersey it might be natural to expect considerable variation among the newts within the state but as Noble gives no habitat notes for his New Jersey animals we can learn little from his data. It is quite possible that the Long Island Newts vary among themselves as much as they do from those on the mainland, for I measured a series of 20 aquatic specimens in the American Museum (No. 2736–2754, Long Island, N. Y., Nicolas Pike, 1885) ranging from 73 to 99 mm. with an average of 86.4 and another series of five (No. 3734–3738, Long Island, N. Y., Eugene Smith, April 20, 1895) from 92 to 119 mm., average 109.4. The numbers are small and the localities not given beyond what appears above but the figures seem worth including.

The Pittsburgh region where most of my work was done is a country of carboniferous shale, weathering to a heavy clay. There are a number of limestone outcrops and some coal seams. It is an old peneplain of about 1200 feet elevation through which the rivers have cut channels to a depth of nearly 500 feet. The country for a mile or two back from the rivers is cut up with steep sided gullies, generally wooded with hardwood timber, which the brooks are constantly deepening, hence the region is very completely drained and most of the streams are too rapid for *Triturus* to live in. The only ponds I have seen aside from a few shallow oxbows of brooks are artificial, Denny's Pond mentioned above being part of the old Pittsburgh and Lake Erie Canal. All of the newts included in the

study as of this region came from within 15 or 20 miles of the city where conditions are essentially the same. It might be added that most of the streams are badly polluted with pumpings from the coal mines.

In regard to the skin texture Noble seems to have made a careful study and he is probably right. Nevertheless it might be noted that Mrs. Wilder (1925) has found a similar spinose condition in the skin of molting larval or metamorphic specimens of *Eurycea bislineata* and it is possible that this condition would not always appear in the red eft.

Noble's records for the hibernation of Long Island newts can hardly be taken to contradict my conclusions for those on the mainland, which are confirmed by several other observers.

## Conclusions

Noble seems to have discovered a local variety of *Triturus* on Long Island that will repay considerable further study. The finding of immature postmetamorphic newts in the water is important but it should be followed up by collectings made at all times of the year when the animal is active and from as many habitats as possible. This should be supplemented by the rearing of larvae from Long Island in the laboratory.

The duration of the land stage cannot be fully settled until somebody succeeds in collecting and studying a large series from one locality, taken at various times of year. I have often been told of hundreds being found with little trouble but none of my trips to the localities where they are sometimes common has yielded more than a few nor have my friends who lived there been able to get me very many. Further there are no large series to be found

in the Agassiz, American or Carnegie Museums. If anyone who reads this will undertake to get me such a series I shall be very glad to hear from him.

PHILIP H. POPE

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LITERATURE CITED

1. Noble, G. K. 1926. "The Long Island Newt: A Contribution to the Life History of *Triturus viridescens*." Amer. Mus. Nov., No. 228, Oct. 13, 1926.

2. Pope, P. H. 1924. "The Life History of the Common Water Newt (*Notophthalmus viridescens*) Together with Observations on the Sense of Smell." Ann. Carnegie Mus., XV, pp. 305–362, Pls. XLI—LI.

3. Monks, Sarah P. 1880. "The Spotted Salamander." Amer. Naturalist, Vol. XIV, pp. 371–374.

4. Gage, Simon H. 1891. "Life History of the Vermilion-Spotted Newt (*Diemyctylus viridescens* Raf.)." Amer. Naturalist, Dec., 1891.

5. Wilder, Inez W. 1925. "The Morphology of Amphibian Metamorphosis." Smith College Fiftieth Anniversary Publications.

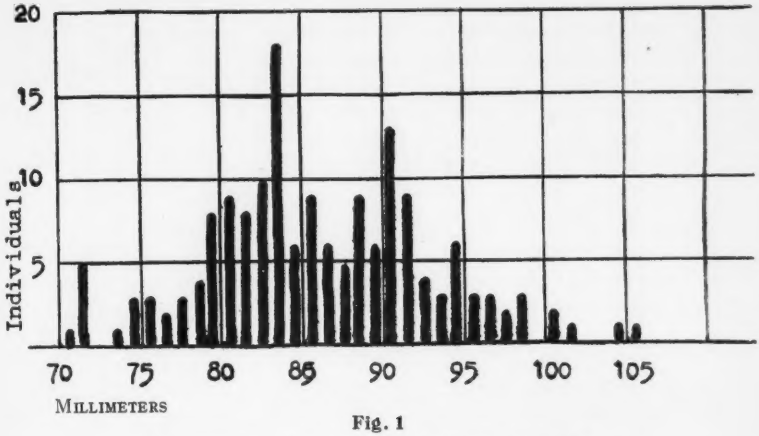


**Fig. 1**

. Measurements of 167 newts from Sunderland, Mass.

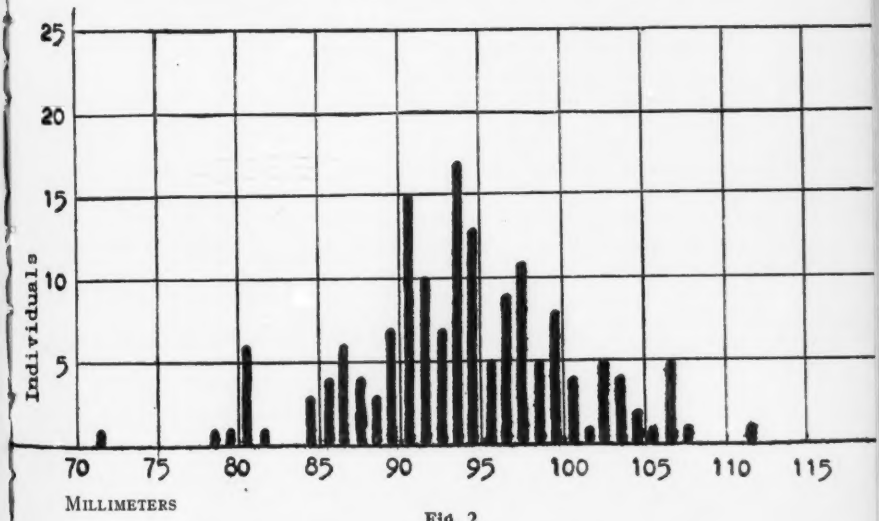


**Fig. 2**

Measurements of 164 newts from Harmar, Pa.

## THE NILOTIC CROCODILE

I was much interested in Mr. Hubbard's almost unique account (Copeia No. 165, p. 115–6) of his watching a crocodile fishing in daylight.

Mr. Hubbard's record of a 17-foot crocodile is a very fine one and I have only heard of two larger, both cited by C. W. Hobley (Jour. East Africa & Uganda Nat. Hist. Soc., 1919, p. 407; 1921 p. 61). He quotes the late R. J. Cumminghame as saying "The only authentic measurement of a big crocodile that I can vouch for was one of my own, it was eighteen feet from tip of snout to tip of tail, measured between perpendiculars. Locality Fajao, by the Murchison Falls, Victoria Nile."

He also cites Mr. B. Eastwood of the Uganda Railway with regard to a still larger reptile killed by the Duke of Mecklenberg not far from Mwanza in May 1905. The Duke, who travelled from Mwanza to Bukoba with Mr. Eastwood, told the latter that it measured six and a half metres, or nearly twenty-one and a half feet.

When, however, Mr. Hubbard says that "crocodiles undoubtedly kill more game than any other single species of predatory creature. They also kill more human creatures", I think his generalization is much too sweeping; it may be so in certain localized, crocodile-infested areas, and in Africa south of the Zambezi where lions are now scarce, but in East Africa I feel sure it is not the case.

The Tanganyika Government records two hundred natives killed by lions per annum, and this is probably an underestimate based on reported cases while many go unreported. In districts where crocodiles become a pest the administrative officer does not lose much time in reporting deaths to the Game Department, but such reports were uncommon. Usually when a native is taken from a village it has the effect of making the people more wary in approaching the

water, the women tie cocoanut shells to long wands, and bail the water into their gourds from a safe distance. After a time they grow less cautious with the result that some other unwary soul is carried off, so that such cases only occur in cycles of one or two months. More are perhaps taken at fords where strangers to the district must perforce cross. During the exceptional campaign conditions in the Rufigi delta in 1916–7 where porters had to march waist-deep in water, not a few lost their lives to crocodiles.

My friend, Dr. Friedmann, who concurs in my impressions from his own African experience, reminded me of Lang's observations (in Schmidt Bull. Am. Mus. Nat. Hist. XXXIX, Art. 11, pp. 424). "Discarding all rumors, our inquiries of officials who had resided ten years or more in the Congo failed to bring to light a dozen actual cases, and I can furnish no better proof of the scarcity of accidents from this cause than the fact that the Congo Expedition, during six years, employed over 38,000 porters and had dealings with several hundred thousand natives, and yet in all that time not one authentic case of loss of human life due to crocodiles came to our notice."

The passing European is liable to get a wrong idea of the frequency of deaths caused by crocodiles as the local natives, always glad to have the reptiles killed, are apt to give him the impression that deaths occurred quite recently "yesterday" in the hope that they may stimulate the European's interest in killing one.

Personally I should estimate the deaths from crocodiles for the whole of Tanganyika Territory as not exceeding fifty natives per annum (population, three and a half millions), and again, though without any reliable statistical basis for the opinion which is but a personal impression, I do not think that crocodiles are a very serious menace to game animals whose intelligence causes them to avoid badly infested drinking places.

I have never heard of crocodiles getting caught in steel traps before, but a very satisfactory way of dealing with them was tried out in 1922. Someone related to me how he was sitting with a friend on Ruvu bridge, the river in flood flowing strongly beneath them, when a pair of black legs shot up into the air, kicked vigorously for a moment and then vanished. A few moments later some native came running alone the bank, shouting and futilely throwing stones into the water. They stated that their companion had gone down to draw water, and had not returned. I sent two native trappers to Ruvu for a fortnight and they constructed gun-traps, baited with a live goat, at points along the river bank. They secured three big crocodiles about ten feet in length in that time (shot through the skull with a .303 solid bullet) and lost several others wounded.

Some idea of the numbers of crocodile inhabiting Lake Victoria may be gathered from the undermentioned figures. Following the example set by their predecessors (the German Government), the Tanganyika Administration authorized a reward of one cent (one-quarter of a U.S.A. cent) per egg but the numbers brought in to Mwanza and certain other places were so astonishing that a reduction in the reward had to be made and finally it was abolished altogether. The following figures for the first six months of 1922 will help one to appreciate the embarrassment of the Administrative Officer at Mwanza:

| | |
|---|---|
| Bukoba | 51 eggs |
| Kigoma | 230 " |
| Lipumba | 37 " |
| Musoma | 15,493 " |
| Mwanza | 104,602 " |
| Namanyere | 44 " |
| Tabora | 45 " |
| Total | 120,502 in six months |

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# NOTES ON THE HERPETOLOGY OF INDO-CHINA

A small lot of reptiles and amphibians from central Annam, Indo-China, collected by J. T. Wright for the Museum of Comparative Zoology at Harvard, has recently passed through my hands for identification. Through the kindness of Dr. Barbour, Field Museum of Natural History retains a series of duplicates from this collection. The list of species is represented primarily as a vehicle for Mr. Wright's field notes. I am indebted to Mr. Cucinotta for scale counts of the snakes in the Museum of Comparative Zoology.

"This collection was made in central Annam, French Indo-China, on the Hue and Quangtri Rivers. The region near the ocean is cultivated to a great extent, rice being the principal crop. About four months of the year this land is flooded. Few reptiles were found in this region, the most common being *Calotes versicolor*, and snakes were scarce. Collections were made near the mouths of the Hue and Quangtri Rivers. The region west of the Hue, up the Hue River and up the Sang de Track (South River) is mostly jungle. The low mountains are covered by a dense growth. Conditions seemed to be ideal for reptiles, and a good harvest was expected, but they were not to be found. At a camp on the Hue River, at the head of navigation for boats, only two or three lizards were seen in six days, and no snakes at all. The natives did not appear to know anything about either. This was exactly what was met with on the South River, although a few specimens were taken.

"We arrived the latter part of January, and although it was understood that the rainy season was over, we did not have three days in succession without rain for three months. Central Annam is not an ideal place for the collector in any sense of the word. In the jungle, leeches are so bad that it is impossible to stand still. Chiggers and ticks fill in the rest of the

day, and mosquitos take care of the night. It is necessary to take quinine as regular as meals to avoid malaria." (J.T.W.)

## Amphibia

1. *Rana rugulosa* Wiegmann.

Four specimens from Quangtri, near ocean.

"This frog is used for food by the natives, but as a general thing, they are not allowed to grow to such a size, being taken for the market earlier in life."

(J.T.W.)

2. *Rhacophorus leucomystax megacephalus* (Hallowell).

Six specimens from the Hue and Quangtri, near the ocean.

"This frog is not at all plentiful. It appears to do its feeding at night when it may be found on the lower parts of trees." (J.T.W.)

## Reptilia

3. *Peropus mutilatus* (Wiegmann).

A single specimen, very small and with the more distinct juvenile coloration, from Hue, near the ocean.

4. *Hemidactylus frenatus* Duméril and Bibron.

Seventy-one specimens from the Hue, near the ocean; Hue, up river and Quangtri near the ocean.

"Geckos are fairly plentiful on trees, fences and out-buildings." (J.T.W.)

5. *Physignathus cocincinus* Cuvier.

Two specimens, ♂ and ♀, from Hue, up river.

"These specimens were taken along the river, the first on the Hue River, the second on the Sang de Track. Apparently, they spend the day in water, coming out late in the afternoon about sundown to feed along the bank. They are exceedingly wild and hard to secure. On land they are awkward, particularly when running. In the water they move swiftly and

quietly, swimming with long graceful sweeps of the tail. They apparently do not use the feet in swimming." (J.T.W.)

6. *Calotes versicolor* (Daudin).

Fourteen specimens from Hue, near the ocean, and Quangtri, near the ocean.

"This species is the most common lizard in the region near the sea. It spends most of its time off the ground, preferring trees to shrubs. It feeds on insects and is as much at home in a tree as a squirrel. While feeding, I have seen this lizard make surprisingly long jumps from limb to limb, sometimes as much as three feet." (J.T.W.)

7. *Leiolepis bellii* Gray.

A single specimen, from Quangtri, near the ocean.

"This species is apparently very rare, as it was impossible to secure more specimens although about ten natives were sent out in search of this particular one." (J.T.W.)

It seems unlikely that this species should really be rare on the Annamese coast. It is doubtless abundant where habitat conditions are favorable.

8. *Mabuya macularia* (Blyth).

Six specimens from Hue, up river, and Quangtri, in the mountains.

9. *Mabuya longicaudata* (Hallowell).

Eleven specimens from Quangtri, in the mountains and near the mouth of the river.

10. *Mabuya multifasciata* (Kuhl).

Sixteen specimens from Hue, up river, and Quangtri, near the ocean.

"This lizard was rarely seen. Its habits of living make it hard to find. It lives in and under wet and decaying vegetable matter close to the water, to which it will go for safety." (J.T.W.)

11. *Sphenomorphus indicus* (Gray).

Two specimens from Quangtri, in the mountains.

12. *Leiolopisma vittigerum kronfanum* (Smith).

A single specimen from Hue, up river. This locality greatly extends the range of this handsomely colored form. It has been known only from the type locality, Daban, Langbian Plateau, southern Annam.

13. *Lygosoma chalcides* (Linné).

A single specimen from Hue, near the ocean.

14. *Typhlops braminus* (Daudin).

A single specimen from Hue, near the ocean.

"This snake is very rare." (J.T.W.)

Like *Leiolepis*, this form is doubtless abundant in suitable habitat conditions in Annam.

15. *Cylindrophis rufus* (Laurenti).

Two specimens from Hue, near the ocean. Ventrals 187, 189; sub-caudals 5, 7.

"This snake was secured in the salt water lagoons near the mouth of the Hue River. It was caught by a fisherman who was searching in the mud for fish. This specimen had swallowed an eel more than half its size." (J.T.W.)

16. *Ptyas korros* (Schlegel).

A single specimen from Hue, near the ocean. Ventrals 170, sub-caudals 139.

17. *Natrix subminiata* (Schlegel).

A single specimen from Hue, near the ocean. Ventrals 149, sub-caudals 80.

18. *Natrix piscator* (Schneider).

Four specimens from Hue, near the ocean, one from Quangtri, near the ocean. Four ♂, with ventrals 128, 131, 132, 134, and sub-caudals 78, 80, 83 (one tail incomplete). One ♀, ventrals 142, tail incomplete.

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# ON A SMALL COLLECTION OF FISHES FROM CHIRIQUI, PANAMA[1]

Extensive fish collections have been made in central and eastern Panama.[2] The fishes of western Panama, however are largely unknown. Specimens from that region, therefore, are of special interest.

The specimens before the writer were collected in the vicinity of Volcan, in the basin of the Rio Chiriqui Viejo, lying within the State of Chiriqui, at an elevation of 4,000 to 4,500 feet by Fred J. Foster, formerly superintendent of the Fisheries Station at Neosho, Missouri. Mr. Foster made an airplane flight to Volcan from the Canal Zone and during the several hours spent there, he collected the specimens herein listed. Only four species were obtained. At least one larger species was seen which Mr. Foster, however, did not succeed in capturing.

It is of interest to note that only one (*Astyanax ruberimus*) of the four species[3] obtained has been taken in central and eastern Panama. The other three species belong to the fauna of Costa Rica. It was pointed out by Meek and Hildebrand (Pub.

1. Published by permission of the U. S. Commissioner of Fisheries.
2. For accounts of recent collections of fresh water fishes from Panama see:
   a. The fishes of fresh waters of Panama by Seth E. Meek and Samuel F. Hildebrand, Publication, Field Museum of Natural History, Zoological Series, Vol. X, 1916, pp. 217-374. Chicago.
   b. New Loricariate, Characin and Poecilid fishes from the Rio Chucunaque, Panama by C. M. Breder, Jr., American Museum Noviates, No. 180, 1925, 9 pp. New York.
   c. Notes of fishes from three Panama localities, Gatun Spillway, Rio Tapia and (Caldoinia Bay), by C. M. Breder, Jr., Zoologica, Vol. IV, No. 4, 1925, pp. 137 to 158. New York.
   d. The Fishes of the Rio Chucunaque Drainage, Eastern Panama, by C. M. Breder, Jr., Bulletin, American Museum of Natural History, Vol. LVII, Art. III, 1927, pp. 91 to 176.
   e. Dr. Ellinor H. Behre of the University of Louisiana collected extensively in western Panama. Carl L. Hubbs and George S. Meyers have reported on some of Dr. Behre's collection in miscellaneous papers, but a general report on this collection apparently has not been published to date (1928).
3. The specimens have been deposited in the U. S. National Museum.

Field Mus. Nat. Hist., Zoöl. Ser., Vol. X, 1916, p. 233) that the fish fauna of Panama, so far as known at that time, was essentially South American. Recent records by Hubbs and by Meyers and the small collection now at hand show that the Central American fauna enters western Panama and further information probably will show that the predominating fauna of this region is Central American rather than South American.

1. *Rhamdia rogersi* (Regan)

*Pimelodus rogersi* Regan, Ann. & Mag. Nat. Hist., Ser. 7, XIX, 1907, 259 (Irazu, Costa Rica).

*Rhamdia regani* Meek, Pub. Field Mus. Nat. Hist., Zool. Ser., VII, 1907, 144 (Turrialba and Rio Tiribi, San Jose, Costa Rica).

*Rhamdia brachycephala* Meek (non Gunther) Pub. Field Mus. Nat. Hist., Zoöl. Ser., VII, 1907, 144 (Turrialba, Costa Rica).

The species of the genus *Rhamdia* are numerous in Central America and according to Meek (Pub. Field Mus. Nat. Hist., Zoöl. Ser., X, 1914, p. 103) it is highly probable that, owing to individual variation, an undue multiplication of species has taken place. The specimens in hand vary somewhat from the published accounts of *R. rogersi*, for the eye appears to be smaller (7.25 to 8 in head), the ventral fins are inserted under or in advance of the base of the last dorsal ray, instead of behind it, and the adipose fin appears to be shorter, being much shorter than the head and contained 5 to 6 times in the length of the body. These differences may constitute only variations within the species.

Three specimens of this catfish, respectively 88, 103 and 113 mm. in length, were taken in Miller Spring, flowing into the Rio Chiriqui Viejo. *R. rogersi*, apparently, has been recorded only from Costa Rica.

2. *Astyanax ruberrimus* Eigenmann

*Tetraganopterus panamensis* Gill (non Günther), Proc. Ac. Nat. Sci. Phil., 1876, 336 (Rio Frijoles, Atlantic slope of Panama).

*Astyanax fischeri* Eigenmann & Ogle (non Steindachner) Proc. U. S. Nat. Mus., 1907, 26 (Pacific slope of Panama; Rio Frijoles; Empire; and Panama).

*Astyanax ruberrimus* Meek & Hildebrand, Pub. Field Mus. Nat. Hist., Zool. Ser., X, 1916, 281 (Many parts of both slopes of Panama).

This is the most abundant of all fishes of Panama, occurring everywhere in the fresh waters where collections have been made. Mr. Foster preserved 30 specimens, ranging from 40 to 75 mm. in length, taken in the lagunas Verde, Grande and Gulnai. The species is known from both slopes of Panama and Columbia.

3. *Brachyrhaphis terrabensis* (Regan)

*Gambusia terrabensis* Regan, Ann. & Mag. Nat. Hist., Ser. 7, XIX, 1907, 260 (Rio Grande de Terraba, Costa Rica).

*Pseudoxiphorus terrabensis* Regan, Proc. Zool. Soc., London, 1913, 993.

*Brachyrhaphis terrabensis* Hubbs, Misc. Pub. No. 16, Mus. Zool. Univ. Mich., 1926, p. 43.

This fish is known only from the Pacific slope of Costa Rica and north western Panama. The structure of the produced part of the anal fin of the male (gonopodium) is very similar to *B. episcopa* (Steindachner). (See Meek & Hildebrand, Pub. Field Mus. Nat. Hist., Zool. Ser., X, 1916, p. 318, fig. 5). The long dorsal fin, containing 13 or 14 rays, readily distinguishes this fish from related species known from Panama.

A series of 52 specimens, ranging from 20 to 70 mm. in length, was collected, in part in Miller Spring, flowing into the Rio Chiriqui Viejo, and in part in the Rio Chiriqui Viejo, at an altitude of 4,500 feet above which no fish was seen.

4. *Rivulus isthmensis* Garman

*Rivulus isthmensis* Garman, Memoir, Mus. Comp. Zool., XIX, 1895, 140 (Rio San Jose, Costa Rica).

*Rivulus flabellicauda* Regan, Ann. & Mag. Nat. Hist., Ser. 7, XIX, 1907, 64 (Juan Vinas, Costa Rica); Regan, Biol. Cent. Amer., Pisc., 1907, 81, fig. 6.

Twenty-seven specimens, ranging from 23 to 76 mm. in length were taken in the lagunas Verde, Grande, and Gulnai. *R. isthmensis* has been recorded only from Costa Rica. According to Meek (Pub. Field Mus. Nat. Hist., Zool. Ser., X, 1914, p. 110) *R. isthmensis* originally was erroneously described as having 32 scales in a lateral series, whereas it actually has 42. Apparently upon the strength of this discovery he assigned *R. flabellicauda* Regan to the synonymy of *R. isthmensis* which appears to be correct. A. C. Weed of the Field Museum of Natural History has kindly examined specimens and enumerated scales and fin rays for the author on fish taken in Costa Rica. The only difference noticed is a slightly larger average number of scales in a lateral series in the Panama specimens, the range for 23 fish being 38 to 48 with an average of 43. In an equal number of specimens from San Jose, Costa Rica, the range is from 35 to 45 with an average of about 40½. This small difference very probably has no significance. George S. Meyers (Ann. and Mag. Nat. Hist., Ser. 9, Vol. XIX, 1927, p. 123) described *R. hildebrandi* from Boquete, Chiriqui, Panama. That species appears to differ from the one in hand in having a somewhat larger number of scales in a lateral series (49 or 50), in having the eye suprolateral, whereas it is strictly lateral in the specimens in hand, and in other minor characters.

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